

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kolman et al (US 6,016,006) in view of Banks et al (US 6,015,722).

Re claim 1, Kolman et al disclose an apparatus (as best shown in Fig 2), comprising:

a die carrier (14) having a surface;

a heat spreader lid (16) having a surface parallel to the surface of the die carrier, the heat spreader lid physically contacting the surface of the die carrier (Fig 2), the heat spreader lid being mounted directly on the die carrier to form a lid cavity (Fig 2);

an integrated circuit die (12) mounted on the die carrier and within the lid cavity;

Re claim 3, wherein heat spreader lid is made of metal (col. 2, lines 15-20).

Re claim 4, wherein, the heat spreader lid includes a thermal interface material (38) interposed in thermal conducting relationship between the heat spreader lid and the die (Fig 2).

Re claim 5, wherein the thermal interface material is coaxially aligned with the die and includes a width and a length dimension which are substantially the same as a corresponding width and a corresponding length dimension of the die (Fig 2).

Re claim 6, wherein the thermal interface material comprises a cold form thermal interface material (Fig 2).

Re claim 7, wherein the die includes a first surface, a second surface and a plurality of lateral sides extending between the first and second surfaces (Fig 9); the first surface includes a plurality of electrical contacts coupled to the die carrier; the second surface is disposed in an abutting relationship with the thermal interface material (Fig 2).

Re claim 8, wherein the die is mounted to the die carrier by a flip-chip mounting (Fig 2).

Re claim 9, wherein the flip-chip mounting includes a plurality of solder bumps (col. 2, lines 8-10) coupling the die to the die carrier.

The teaching as discussed above does not teach a cured mold compound disposed to fill the lid cavity and to at least partially surround the IC die, the cured mold compound being in contact with the surface of the die carrier and the surface of the heat spreader lid (re claim 1), wherein the heat spreader lid has a dispensing hole formed therein to facilitate injection of a mold compound solution into the lid cavity and an air outlet hole formed therein to allow air to escape from the lid cavity (re claim 2), and the mold compound extends between the heat spreader lid and the die carrier and surrounds the lateral sides and the first surface of the die (re claim 7) wherein the mold compound is a polymeric material (re claim 10).

Re claims 1, 2, 7, 10, Banks et al teach the use of a cured mold compound (Fig 7, step 320, 330) disposed to fill the lid cavity and to at least partially surround the IC

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die, the cured mold compound being in contact with the surface of the die carrier and the surface of the heat spreader lid (Fig 9), and the mold compound extends between the heat spreader lid and the die carrier and surrounds the lateral sides and the first surface of the die(Fig 9), wherein the heat spreader lid has a dispensing hole (544) formed therein to facilitate injection of a mold compound solution into the lid cavity and an air outlet hole (546) formed therein to allow air to escape from the lid cavity (col. 27, lines 45-50), wherein the mold compound is a polymeric material (epoxy)(col. 28, lines 16-18). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the molding compound and other features as discussed above with the structure of Kolman et al for the purpose enhancing heat dissipation.

Claims 16-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kolman et al in view of Banks et al and view of Low et al (US 6,404,626).

Re claim 16, Kolman et al disclose a system, comprising:
an integrated circuit package including a die carrier (14); a heat spreader lid (16) physically contacting the surface of the die carrier, the heat spreader lid being mounted directly on the die carrier to form a lid cavity (Fig 2); an IC die (12) mounted on the die carrier and within the lid cavity;

A circuit board or a mother board (external PCB) having mounted thereon the IC package (col. 2, lines 5-10)

Re claim 21, wherein heat spreader lid is made of metal (col. 2, lines 15-20).

Re claim 22, wherein, the heat spreader lid includes a thermal interface material (38) interposed in thermal conducting relationship between the heat spreader lid and the die (Fig 2).

Re claim 23, wherein the thermal interface material is coaxially aligned with the die and includes a width and a length dimension which are substantially the same as a corresponding width and a corresponding length dimension of the die (Fig 2).

Re claim 24, wherein the thermal interface material comprises a cold form thermal interface material (Fig 2).

Re claim 26, wherein the die is mounted to the die carrier by a flip-chip mounting (Fig 2).

Re claim 27, wherein the flip-chip mounting includes a plurality of solder bumps coupling the die to the die carrier (col. 2, lines 5-10).

The teaching as discussed above does not disclose a dynamic random access memory coupled to the IC package; and an input/output interface coupled to the IC package (re claims 16), the IC die being a microprocessor (re claim 17), wherein the input/output interface comprises a networking interface (re claim 18), wherein the system is a selected one of a set-top box, an entertainment unit and a DVD player (re claim 19).

Re claims 16, 20, 25, 28 Banks et al teach the use of a cured mold compound (Fig 7, step 320, 330) disposed to fill the lid cavity and to at least partially surround the IC die, the cured mold compound being in contact with the surface of the die carrier and

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the surface of the heat spreader lid (Fig 9), and the mold compound extends between the heat spreader lid and the die carrier and surrounds the lateral sides and the first surface of the die(Fig 9), wherein the heat spreader lid has a dispensing hole (544) formed therein to facilitate injection of a mold compound solution into the lid cavity and an air outlet hole (546) formed therein to allow air to escape from the lid cavity (col. 27, lines 45-50), wherein the mold compound is a polymeric material (epoxy)(col. 28, lines 16-18). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the molding compound and other features as discussed above with the structure of Kolman et al for the purpose enhancing heat dissipation.

Re claims 16-19, Low et al disclose a circuit board or mother board (100) having mounted thereon the IC package (CPU 102); a dynamic random access memory (106) coupled to the IC package, the IC die being a microprocessor (CPU 102) and an input/output interface (27) coupled to the IC package, wherein the input/output interface comprises a networking interface (75), wherein the system is a selected one of a set-top box, an entertainment unit and a DVD player (Fig 1a)(re claim 19).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the dynamic random access memory coupled to the IC package; and the input/output interface or networking interface coupled to the IC package, the set-top box with the structure of Banks et al for the purpose of making a personal computer.

Response to Arguments

Applicant's arguments with respect to claims 1, 16 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung V. Ngo whose telephone number is (571) 272-1979. The examiner can normally be reached on Monday to Friday 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez can be reached on (571) 272-2800 EXT 31. The fax phone

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number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Hung V Ngo/
Primary Examiner, Art Unit 2831